CLAIMS

I claim:

1. A magnetic head comprising:

a free magnetic layer having two ends;

two hard bias layers, each adjoining a corresponding end of the free magnetic layer, and which create a bias magnetic field within the free magnetic layer;

a bias reduction layer disposed parallel to the free magnetic layer; and

a bias spacer layer disposed parallel to and between the free magnetic layer and the bias reduction layer;

wherein the bias reduction layer creates a magnetic field within the free magnetic layer that is directed oppositely to the bias magnetic field.

2. A magnetic head according to claim 1, wherein the bias spacer layer is comprised of ruthenium or copper.

3. A magnetic head according to claim 1, wherein the bias spacer layer is comprised of ruthenium having a thickness between approximately 8 and 40 angstroms (Å).

4. A magnetic head according to claim 1, wherein the bias spacer layer is comprised of copper having a thickness between approximately 2 and 10 Å.

5. A magnetic head according to claim 1, wherein:

the bias spacer layer includes a bias spacer material and has a bias spacer thickness; and

the bias spacer material and the bias spacer thickness are selected so as to produce a negative magnetic coupling between the free magnetic layer and the bias reduction layer.

6. A magnetic head according to claim 1, wherein the bias reduction layer is comprised of NiFe or CoNiNb.

7. A magnetic head according to claim 1, wherein the bias spacer reduction layer is comprised of NiFe having approximately 80 to 95% nickel.

8. A magnetic head according to claim 1, wherein the bias reduction layer is comprised of CoNiNb having between 60 to 85% Co, and between 20 to 5% Ni, and between 25 to 5% Nb.

9. A magnetic head according to claim 6 wherein the bias reduction layer is approximately 10 Å thick.

10. A magnetic head according to claim 1, wherein:

the bias reduction layer includes a bias reduction material and has a bias reduction

layer thickness; and

the bias reduction material and the bias reduction layer thickness are selected so as to produce a bias reduction magnetic field within the free magnetic layer, wherein the bias reduction magnetic field counteracts the bias magnetic field at positions within the free magnetic layer that are between ends of the free magnetic layer.

11. A magnetic head portion according to claim 1, wherein the hard bias layers induce an edge bias magnetic field within the free magnetic layer at the ends of the free magnetic layer, where the edge bias magnetic field is of sufficient strength to stabilize the free magnetic layer even when partially counteracted by a bias reduction magnetic field created by coupling of the free magnetic layer with the bias reduction layer.

12. A hard disk drive for reading and writing information in a magnetic medium, the disk drive comprising:

a disk having a surface that includes the magnetic medium;

a motor coupled to rotate the disk;

a slider having an air bearing surface;

an actuator configured to hold the air bearing surface of the slider proximate to the surface of the disk;

a magnetic head disposed within the slider and forming part of the air bearing surface, wherein the magnetic head includes:

i) a free magnetic layer having two ends;

ii) two hard bias layers, each adjoining a corresponding end of the free magnetic layer, and which create a bias magnetic field within the free magnetic layer;

iii) a bias reduction layer disposed parallel to the free magnetic layer;

iv) a spacer layer disposed parallel to and between the free magnetic layer and the bias reduction layer; and

wherein the bias reduction layer creates a magnetic field within the free magnetic layer that is directed oppositely to the bias magnetic field.

13. A hard disk drive according to claim 12, wherein the bias spacer layer is comprised of ruthenium or copper.

14. A hard disk drive according to claim 12, wherein the bias spacer layer is comprised of ruthenium having a thickness between approximately 8 and 40 Å.

15. A hard disk drive according to claim 12, wherein the bias spacer layer is comprised of copper having a thickness between approximately 2 and 10 Å.

16. A hard disk drive according to claim 12, wherein:

the bias spacer layer includes a bias spacer material and has a bias spacer thickness; and

the bias spacer material and the bias spacer thickness are selected so as to produce

a negative magnetic coupling between the free magnetic layer and the bias reduction layer.

17. A hard disk drive according to claim 12, wherein the bias reduction layer is comprised of NiFe or CoNiNb.

18. A hard disk drive according to claim 12, wherein the bias spacer reduction layer is comprised of NiFe having approximately 80 to 95% nickel.

19. A hard disk drive according to claim 12, wherein the bias reduction layer is comprised of CoNiNb having between 60 to 85% Co, and between 20 to 5% Ni, and between 25 to 5% Nb.

20. A hard disk drive according to claim 12, wherein the bias reduction layer is approximately 10 Å thick.

21. A hard disk drive according to claim 12, wherein:

the bias reduction layer includes a bias reduction material and has a bias reduction layer thickness; and

the bias reduction material and the bias reduction layer thickness are selected so as to produce a bias reduction magnetic field within the free magnetic layer, wherein the bias reduction magnetic field counteracts the bias magnetic field at positions within the

free magnetic layer that are between ends of the free magnetic layer.

22. A hard disk drive according to claim 12, wherein the hard bias layers induce an edge bias magnetic field within the free magnetic layer at the ends of the free magnetic layer, where the edge bias magnetic field is of sufficient strength to stabilize the free magnetic layer even when partially counteracted by a bias reduction magnetic field created by coupling of the free magnetic layer with the bias reduction layer.